COMPARISON OF THE EFFECTIVENESS OF BOBATH THERAPY AND CLASSIC KINESITHERAPY ON GAIT FUNCTION IN PATIENTS WITH ISCHEMICAL STROKE

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ABSTRACT

Introduction: Stroke is a global health problem today, the need for rehabilitation is extremely significant, focused primarily on restoring and maintaining activities of daily living.

Research Objective: To investigate the comparison of the effectiveness of classical kinesitherapy treatment and the Bobath concept on walking function in patients with hemiparesis after ischemic stroke.

Subjects and Methods: The study group consisted of patients who received classical kinesitherapy treatment, the control group received Bobath therapy. All patients underwent rehabilitation at the Clinic for Physical Medicine and Rehabilitation of the University Hospital Mostar, and were tested twice, before and after the treatments, using the Berg balance scale (BBS), gait function according to the Timed Up and Go Test (TUG), and the Barthel Index for assessing ten functional tasks of daily life (activities of daily living - ADL).

Results: Bobath therapy showed greater effectiveness compared to subjects treated with a classical kinesitherapy program by comparing the results of the BBS. The Berthel index showed a statistically significant difference in the results at the beginning and end of treatment in the group of subjects treated with Bobath therapy. No statistically significant difference was shown between the subjects by measuring the TUG test. A statistically significant positive correlation was shown between activities of daily life and dynamic balance with the functional recovery of the subjects. Gender, age, foreign bodies affected by hemiparesis did not show a significant relationship with the functional status of the subjects.

Conclusion: Bobath therapy has a significantly better effect on walking function and improvement of daily life activities of patients after ischemic stroke. Both treatments significantly lead to better functional recovery and dynamic balance of patients after ischemic stroke.

Keywords: stroke; Bobath concept; kinesitherapy; rehabilitation

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INTRODUCTION

Stroke is a global health problem, it is increasing every day, expected that by 2030 there will be 70 million people who have survived a stroke (1). About more than 80% represent an ischemic stroke, characterized by occlusion of a blood vessel due to the action of an embolus or thrombus (2). The main characteristics of this condition are abnormal muscle tone and abnormal movement patterns that lead to impaired postural control. The Bobath concept is based on the principles of neurodevelopmental treatment, the focus of which is a holistic approach to the patient's motor and other problems, prevention of compensations, striving for a normal form of movement and daily motor activities. The Bobath concept aims to normalize the movement pattern and establish postural control of all body parts (3) . Kinesitherapy is aimed primarily at restoring and maintaining activities of daily life, properly dosed intensity of kinesitherapy is the most important factor in recovery (4). Upper motor neuron damage causes changes in muscle tone, muscle weakness, spasticity, contractures and impaired motor control, all of which affect everyday activities of reaching, picking up and holding objects, and walking (5). In order to increase the effectiveness of treatment, therapeutic treatments must be evidence-based and focus on specific segments of the intervention. The most important goal of rehabilitation is the recovery of independent, safe and long-term walking, which is the basic motor function that allows a person to function normally on a daily basis. For most patients, walking after a stroke is possible, but the patient rarely regains a normal walking pattern. Mass movement patterns, associated reactions and compensations prevail, which distance the person from the quality of normal life. Therefore, relearning to walk is a very important intervention within physiotherapy, and thus the overall rehabilitation treatment (6,7).

OBJECTIVE

To investigate the impact of classical kinesitherapy treatment and the Bobath concept on walking function in patients with hemiparesis after ischemic stroke.

RESEARCH METHODS

For the purposes of this study, a convenience sample was used, which included 50 subjects with ischemic stroke and hemiparesis of the left or right side of the body, equally including both sexes. The subjects were included in the rehabilitation process of the Clinic for Physical Medicine and Rehabilitation of the University Clinical Hospital Mostar in the period from February 1 to August 1, 2017. Inclusion criteria for the study included a medical neurological diagnosis of cerebrovascular insult diagnosed on the basis of magnetic resonance imaging, the presence of hemiparesis. Exclusion criteria from the study included patients with central nervous system trauma, post-tumor conditions, patients who were unable to participate in the study due to a psychiatric diagnosis or cognitive impairment. Subjects were randomly assigned to two study groups: the test and the control. The test group underwent classical kinesitherapy treatment, the control group underwent neurofacilitation treatment according to the Bobath concept.

Test group underwent 10 classical kinesitherapy treatments lasting 45 minutes per day for two weeks, the control group underwent 10 Bobath therapy treatments lasting 45 minutes per day for two weeks.

Berg balance scale is a questionnaire used to assess functional balance during a series of predetermined tasks. It consists of 14 mobility items, each with 5 points, ranging from 0 to 4,

the number 4 indicates the highest function, the patient is able to perform the task independently, and 0 the lowest, the patient is unable to perform the task independently (8).

Timed Up and Go Test (TUG) is a test for assessing mobility and the risk of falling. To perform the test, a chair with a backrest, a marked 3-meter path, and a stopwatch are required. The patient sits on a chair, is asked to get up from the chair, walk 3 meters, then turn around, walk back and sit down on the chair again. The measurement is performed 2 times, the shorter the performance time indicates a better result. Time up to 20 seconds – independently mobile, from 20 to 29 seconds – uncertain, over 29 seconds – requires assistance in moving and standing up (9,10).

Bartel Index measures the patient's ability to perform activities of daily living. It assesses ten functional tasks of daily living, rating the patient for each functional task individually, then adding up the functional tasks obtained. The scores range from 0 to 100, with a higher score indicating greater independence. A score of 0 to 20 indicates complete dependence, 21 to 60 indicates severe dependence, 61 to 90 indicates moderate dependence, 91 to 99 indicates mild dependence, and 100 indicates the patient is independent in all aspects of daily life (11,12).

The patients were tested twice, before and after the treatments, using the Berg balance scale (BBS), gait function according to the Timed Up and Go Test (TUG), and the Barthel Index to assess ten functional tasks of daily life (activities of daily living - ADL). The treatment process was explained in detail to all patients who met the criteria for inclusion in the study, and they signed an informed consent to participate in the study. The consent of the Ethical Committee of the SKB Mostar was obtained, the conducted research is in accordance with the Declaration of Helsinki and the principles of quality medical practice.

Statistical data processing

The probability distribution of quantitative variables was tested for normality with the Smirnov-Kolmogorov test. Data whose distribution of variables did not deviate from normal were presented as arithmetic means (M) and standard deviations (SD), and the t-test for independent samples was used to determine statistical differences. The median (M) and interquartile range (Ir) were used to display the mean value and measure of dispersion for continuous variables whose distribution significantly deviated from normal, and the Kruskal-Wallis test was used to determine differences between groups. The $\chi 2$ test was used to analyze nominal variables. The association of quality of life and functional recovery with gender and age of the subjects was assessed using the Spearman rank correlation coefficient. The possibility of error was accepted at $\alpha<0.05$, and differences between groups were accepted as statistically significant for $P<0.05$. P values that could not be expressed to a maximum of three decimal places were shown as $P<0.001$. The SPSS for Windows (version 13.0, SPSS Inc, Chicago, Illinois, USA) and Microsoft Excel (version Office 2007, Microsoft Corporation, Redmond, WA, USA) software systems were used for statistical analysis of the obtained data.

RESULTS

Table 1. *Comparison of sociodemographic characteristics between the study groups*

Parameters	Classic Kinesiotherapy Treatment (N=25)		Bobath Therapy (N=25)		X^2 Test	P
	No.	%	No.	%		
Gender						
Male	16	64,0	11	44,0	2,013	0,155
Female	9	36,0	14	56,0		
Hemiperesis						
Right	14	56,0	12	48,0	0,321	0,571
Left	11	44,0	13	52,0		
	*M(SD)		**M(SD)		t-test	p
Age	63,8 (13,1)		65,4(11,3)		1,078	0,326

*M – Arithmetic Environment; **SD – Standard deviation

Sociodemographic characteristics between the test and control groups were not statistically significant by gender, age, or side of the affected extremity.

Table 2. *Comparison of functional recovery measured by the Berg balance scale between groups at the beginning and end of the 2-week therapeutic treatment*

Berg Balance Scala	Classical kinesitherapy treatment (n=25)	Bobath therapy (n=25)	p*
	M (SD)	M (SD)	
At the beginning of treatment	26,2 (3,2)	26,8 (3,1)	0,245
At the end of treatment	47,3 (2,2)	48,8 (1,5)	0,010
p*	<0,001	<0,001	

*M – Arithmetic Environment; **SD – Standard deviation

Statistical analysis of the results at the beginning and end of treatment showed a statistically significant difference in both groups ($p<0.001$). By comparing the results of the BBS scale between the studied groups, the functional status assessed by the BBS in subjects treated with Bobath therapy showed a statistically significantly greater difference compared to subjects treated with a classical kinesitherapy program ($p=0.010$).

Table 3. *Comparison of the results obtained by the Berthel index between the groups at the beginning and at the end of the two-week therapeutic treatment*

Barthel index	Classical kinesitherapy treatment (n=25)	Bobath therapy (n=25)	p*
	M (Ir)	M (Ir)	
At the beginning of treatment	80,0 (51,5)	79,0 (45,0)	0,453
At the end of treatment	86,0 (23,5)	95,0 (18,5)	0,267
p*	0,069	<0,001	

* Mann-Whitney U test

Statistical analysis of the responses to the domains in the Berthel index showed a statistically significant difference in the results at the beginning and at the end of the treatment in the group of subjects treated with Bobath therapy ($p<0.001$). There was also an improvement in the activities of daily life in subjects treated with classical kinesitherapy treatment, which was not statistically significant ($p=0.069$). A comparison of the results of the survey between the two examined groups at the end of their treatments did not show a statistically significant difference ($p=0.267$).

Table 4. *Comparison of TUG test results between groups at the beginning and end of two-week therapeutic treatment*

***TUG** test*	Classical kinesitherapy treatment (n=25)			Bobath therapy (n=25)			p^*
	independent	uncertain	help needed	Independent	uncertain	help needed	
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
At the beginning of treatment	-	12 (48,0)	13 (52,0)	-	10 (40,0)	15 (60,0)	0,568
At the end of treatment	14 (46,0)	7 (28,0)	4 (16,0)	17 (68,0)	7 (28,0)	1 (4,0)	0,351**
p^*	<0,001			<0,001**			

*χ^2 test; **Fisherov egzaktni test

Statistical analysis of the results at the beginning and end of treatment showed a statistically significant difference in both groups (p<0.001), with both groups showing improvement. Comparison of the TUG test results between the groups at the end of treatment showed no statistically significant difference.

Table 5. *Correlation between the observed parameters and functional recovery of the subjects determined by Spearman's correlation coefficient*

	*Spearman's rho	P
Gender	0,084	0,890
Age	0,007	0,964
Foreign body affected by hemiparesis	0,070	0,628
Activities of daily living	0,368	0,008
Dynamic balance	0,293	0,039

*Spearman's rho

Spearman's rank correlation coefficients between the observed variables and the functional recovery of the subjects at the end of treatment measured using the BBS. A statistically significant positive correlation was shown between activities of daily living (p=0.008) and dynamic balance (P=0.039) with the functional recovery of the subjects. Improvement in activities of daily living and greater dynamic balance were significantly associated with better functional recovery of the subjects after the treatment. Gender, age of the foreign body affected by hemiparesis did not show a significant association with the functional status of the subjects.

DISCUSSION

About 80% of ischemic strokes are characterized by occlusion of a blood vessel due to the action of an embolus or thrombus (2). Risk factors for younger stroke patients differ from those of middle-aged and elderly patients, and these manifestations are significantly more complicated in younger stroke patients (13). The main goal of the Bobath concept is to normalize movement patterns and establish postural control by manipulating all parts of the body (shoulder, arm, hip, knee) (3). Physiotherapy is commonly used in the rehabilitation of stroke survivors, and properly dosed intensity of physiotherapy is the most important factor in the recovery of stroke patients (4,14). Meschia et al. conducted a systematic search of relevant databases in the period from 2009 to 2012 on the importance of prevention in identifying risk factors for stroke. On this occasion, they stated that 795,000 people in the USA suffer from stroke annually, making this condition the fourth leading cause of death. The same authors state that in 1993 and 1994 the most common age of patients for stroke was 71.2 years and the incidence rate decreased to 69.2 years during 2005, which was also shown in this study where the incidence rate by age was 63.8 years. The study showed that

cerebrovascular diseases are the first cause of death in women and the second cause of death in men in developed countries (15). In the study, there was no statistically significant difference in relation to age in the study groups, in the study group the average age of the subjects was 63.8 (SD 13.1) and in the control group the average age of the subjects was 65.4 (SD 11.3). This is explained by the fact that in older age, damage to the cardiovascular system occurs, which, along with age, is one of the leading predictive factors for stroke. Malik et al., in a multicenter study investigating the association of genetic factors with stroke in the United States, reported that the left hemisphere of the brain was more frequently affected (16). There was no statistically significant difference between the study groups in which foreign bodies were more frequently affected by stroke.

In a study conducted by Liphart and colleagues in the United States on gait and balance function, measured with the Berg Balance Scale in the second and twelfth months after stroke, it was shown that this scale was highly reliable in assessing static and dynamic balance through 14 functional actions in a certain position or through a change in position. The scores were recorded from 0 to 4 and the maximum number of points was 56. The study showed a decrease in the incidence of falls in these patients between two and twelve months after stroke and better functional ability between the observed periods (17).

Study showed a statistically significant difference in both groups ($p<0.001$). When comparing the BBS results between the studied groups, the functional status evaluated by the BBS in the subjects treated with Bobath therapy showed a statistically significantly greater difference compared to the subjects treated with the classical kinesitherapy program ($p=0.010$).

In a study by Harrison et al. on scales for assessing functional activities of stroke survivors, the Barthel Index was listed as the most commonly used functional measure in stroke rehabilitation settings and the second most commonly used functional outcome measure during post-stroke functional assessments. The authors of the Barthel Index, Florence I Mahoney and Dorothea W Barthel, intended their criteria to be used as a "simple index of independence useful for achieving improvements in rehabilitation". It was first described in the 1950s and published in 1965 (12).

In this study, in the test group treated with classical kinesitherapy treatment, consisting of 25 (50%) subjects, the range of Barthel Index values at the beginning of treatment was 80.0 (55.1), and at the end of treatment the range of values was 86.0 (23.5), which was not statistically significant ($p=0.069$). The control group of patients treated according to the Bobath concept, also 25 (50%) of them, at the beginning of treatment had a total mean score of Barthel Index of 79.0 (45.0), while at the end of treatment the total mean score was 95.0 (18.5), which was statistically significant ($p<0.001$). Comparing the results of the two test groups on There was no statistically significant difference at the end of their treatments ($p=0.267$).

In a study investigating tests for assessing mobility in stroke patients conducted in Gothenburg in 2014, Persson et al. reported that a frequently used clinical test for assessing functional mobility is the TUG test. The TUG test has shown a high degree of reliability in patients with ischemic stroke, as well as in elderly patients who were included in geriatric day care. Furthermore, the TUG has been shown to be valid and to identify the risk of

falling in older adults as well as in stroke patients. For this latter study, the risk of falling was identified as the inability to perform the TUG test. Studies confirm that neurological recovery generally occurs early after stroke. The Timed Up & Go test has been shown to be a good measurement tool for detecting changes in mobility over time in stroke patients. The TUG test tested subjects for standing, walking and sitting in seconds, where the subject stands up from a standard chair, walks 3 m from the chair, turns 360°, walks back to the chair and sits down, and is estimated to be independently mobile up to 20 seconds, from 20 to 29 seconds – uncertain, over 29 seconds – needs assistance with movement and standing.

Therefore, all of the above justifies the use of the TUG test in stroke rehabilitation (10).

This study showed that in the test group treated according to classical kinesitherapy treatment and evaluated with the TUG test, out of a total of 25 (50%) patients, none were independent, those who performed the complete test were uncertain, 12 (48%) were those who performed the test but with uncertainty, and 13 (52%) patients needed assistance when performing the test. At the end of the treatment, the TUG test showed 14 (46%) independent patients, 7 (28%) uncertain patients and 4 (16%) patients in need of assistance. The control group, which included patients treated with Bobath therapy, also consisted of 25 (50%) patients. At the beginning of the treatment, there were no independent patients, 10 (40%) were unsure, while 15 (60%) needed help. At the end of the treatment, according to the TUG test, there were 17 (68%) independent, 7 (28%) unsure and 1 (4%) patients who needed help. At the beginning and at the end of the treatment, there was a statistically significant difference in both groups ($p<0.001$), where there was an improvement in both groups after the treatments, while there was no statistically significant difference between the tested groups.

The rank correlation coefficients between the observed variables measured by the Berg Balance Scale (BBS) are presented. Activities of daily living measured by the Barthel Index (BI) ($p=0.008$) and dynamic balance measured by the TUG test ($p=0.039$) are directly related to the functional recovery of our patients after the treatments, while gender and foreign bodies affected by hemiparesis had no statistically significant effect on the outcomes of rehabilitation procedures and the functional status of patients.

CONCLUSION

Bobath therapy has a statistically significantly better effect on gait function and improvement of activities of daily living in patients after ischemic stroke compared to classical kinesitherapy treatment. Classical kinesitherapy treatment and Bobath therapy have a significant impact on the functional recovery of patients after ischemic stroke. Both treatments significantly lead to better dynamic balance in patients after ischemic stroke.

GENERATIVE AI STATEMENT

The corresponding author declared that generative AI was not used in the creation of this manuscript.

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USPOREDBA UČINKOVITOSTI BOBATH TERAPIJE I KLASIČNE KINEZITERAPIJE NA FUNKCIJU HODA PACIJENATA S ISHEMIJSKIM MOŽDANIM UDAROM

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SAŽETAK

Uvod: Moždani udar predstavlja globalni zdravstveni problem današnjice, potreba za rehabilitacijom iznimno je značajna, usmjerena prvenstveno na obnavljanje i održavanje aktivnosti svakodnevnog života.

Cilj istraživanja: Istražiti usporedbu učinkovitosti klasičnog kineziterapijskog tretmana i Bobath koncepta na funkciju hoda kod pacijenata sa hemiparezom nakon ishemijskog moždanog udara.

Ispitanici i metode: Ispitnu skupinu su činili bolesnici s kojima se provodio klasični kineziterapijski tretman, kontrolna skupina provodila je Bobath terapiju. Svi bolesnici su provodili rehabilitaciju u Klinici za fizikalnu medicinu i rehabilitaciju Sveučilišne kliničke bolnice Mostar, testirani su u dva navrata, prije i nakon provedenih tretmana koristeći se Berg balance scale (BBS), funkcije hoda prema Timed Up and Go Test (TUG), i Barthel Indeksa za procjenu deset funkcionalnih zadataka svakodnevnog života (aktivnosti dnevnog života - ADL).

Rezultati: Bobath terapija pokazala je veću učinkovitost u odnosu na ispitanike tretirane klasičnim kineziterapijskim programom usporedbom rezultata BBS. Berthel indeks pokazao je statistički značajnu razliku u rezultatima na početku i na kraju tretmana u skupini ispitanika tretiranih Bobath terapijom. Nije pokazana statistički značajna razlika između ispitanika mjerenjem TUG testa. Pokazala se statistički značajna pozitivna korelacija između aktivnosti svakodnevnog života i dinamičke ravnoteže s funkcionalnim oporavkom ispitanika. Spol, dob strana tijela zahvaćena hemiparezom nisu pokazali značajnu povezanost s funkcionalnim statusom ispitanika.

Zaključak: Bobath terapija ima značajno bolji učinak na funkciju hoda i poboljšanje aktivnosti svakodnevnog života bolesnika nakon ishemijskog moždanog udara. Oba tretmana značajno dovode do boljeg funkcionalnog oporavka i dinamičke ravnoteže bolesnika nakon ishemijskog moždanog udara.

Ključne riječi: moždani udar; Bobath concept; kineziterapija; rehabilitacija

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